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| Patents ADP number *(if you know it)* | 8101271001 |
| If the applicant is a corporate body, give the country/state of its incorporation | Belgian |
| 4. Title of the invention | Novel Device |
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R F Walker

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# Novel Device

This invention relates to a processing station for performing an operation on a medicament container such as a vial or syringe for containing a medicinal product such as a drug or vaccine substance. In particular this invention relates to a processing station for performing a filling operation on such a container.

In the pharmaceutical industry containers of a liquid medicament substance are normally filled with a medicament substance by sending empty containers along a conveyor line and filling them individually or in groups at a processing station adjacent to the line by introducing a thin hollow tube, e.g. a pointed-ended hollow needle into them, and passing a liquid medicament into the container along the tube. For this purpose a so-called "walking frame" is often used, comprising a frame holding plural tubes, which can be moved in parallel to the conveyor line and then lowered so that the tubes can enter the container, the containers being filled with the medicament, the tubes withdrawn, and the container sealed. Vials and syringes can be filled in this way.

It is important to do this filling operation in a sterile environment to avoid any contamination of the medicament substance. To achieve this the conveyor line, vials and processing station are normally maintained in a flow of sterile air directed downwardly onto them from above, i.e. a so-called laminar flow of sterile air. A problem with known laminar flow systems is that often the components of processing stations are often angular in shape and/or have numerous recesses, corners etc. which can cause turbulence in the laminar flow and are not easily swept by such a laminar flow, and sterility can be compromised for example if micro-organisms are able to reside in such recesses etc. Additionally the laminar flow can be disrupted as the air flows over the processing station. This can cause the processing station to fail to comply with Good Manufacturing Practice ("GMP").

A known method of filling a medicament container in a sterile environment is disclosed in US 2002/0023409-A "Medicament vial having a heat-sealable cap, and apparatus and method for filling the vial". In this disclosure a vial is provided with a puncturable cap made of a thermoplastic material, a hollow filling needle is passed through the cap and liquid content introduced into the vial, displaced air

being released through a second hollow needle, the needle(s) are withdrawn, and the residual puncture hole(s) sealed by directing a laser beam onto the puncture site.

It is an object of this invention to provide an improved processing station for use in a process for filling medicament containers, particularly for the process of US 2002/0023409-A.

According to this invention a processing station for performing an operation on an article in a laminar upstream to downstream direction flow of purified air comprises;

a processing apparatus for performing the operation upon the article,

an aerodynamic shroud around at least part of the apparatus and positioned such that a leading surface of the aerodynamic shroud is upstream of the apparatus.

The processing station is preferably a processing station for performing an operation on a medicament vial or a syringe, particularly a filling and/or sealing operation. The article, or plural articles, is/are preferably mounted on a conveyor system which may be of generally conventional construction. Such a conveyor system is located adjacent to the processing station, preferably located downstream of the processing station relative to the airflow. Preferably the processing station is located above the conveyor so as to be able to perform the operation on articles below the processing station, e.g. by a downward movement of the processing station, or an upward movement of the article.

The upstream to downstream flow direction of purified air is preferably a downward flow of sterilised air, e.g. sterilised to Class 100 or better. The processing station of the invention is suitable for air flow rates as provided by conventional laminar flow generators. The processing station is therefore preferably located above the conveyor.

In one embodiment, where the operation is a filling operation for a medicament container, the processing apparatus for performing the operation comprises a filling apparatus. For example such a filling apparatus may comprise one or more, preferably five, ten or more, hollow filling needles, each connected, preferably each individually connected, to a source of liquid medicament for example via a flow line connected to the needle by a suitable connector such as a

luer lock. Such a source may for example comprise a reservoir of the medicament and a metering pump.

In another embodiment, where the operation is a sealing operation where a vial or syringe is closed by a puncturable thermoplastic closure having a residual puncture hole therein, the processing apparatus may comprise a source of intense light which may be directed onto the region of the residual puncture hole to fuse the material of the puncture hole around the hole. The light may be laser light, for example directed by one or more optical fibre conveying such light. Such a processing station preferably also comprises a thermal sensor to monitor the temperature reached by a surface onto which such light is directed and optionally an extraction manifold to remove fumes emitted by the surface in response to the heat generated by the intense light directed thereon.

In such a processing station the intense light may be directed at the residual puncture hole of the stopper and the thermal user may detect and measure the consequent elevated temperature of the site where the light is directed. Monitoring and control equipment connected to the processing station may confirm that an elevated temperature sufficient to fuse the closure material in the vicinity of the puncture hole has been achieved.

The aerodynamic shroud surrounds and encloses at least part of the processing apparatus and has a leading surface e.g. a leading edge, upstream of the processing apparatus in the airflow. This arrangement can ensure that smooth undisrupted laminar flow of the purified air is maintained over the apparatus, other parts of the processing station and over equipment such as a conveyor line downstream of the shroud. The aerodynamic shroud preferably has a smooth outer surface, as far as feasible without recesses, corners etc in which microorganisms can collect. Part(s) of the processing apparatus at the downstream (e.g. lower) end of the aerodynamic shroud may be exposed to enable interaction thereof with the article upon which the processing station is to operate. Such part(s) may extend beyond a trailing, downstream end e.g. a trailing edge, through which the processing apparatus may be accessed.

Typically in its longitudinal, i.e. upstream-downstream direction, section the shroud may have a generally aerofoil section, e.g. an elongated elliptical section or

an elongated pear-shaped section. Preferably the section is an elongated pear-shape with the leading edge of the section, being the wide end of pear-shape, upstream e.g. uppermost. The longitudinal section is preferably symmetrical as there is no need for the aerodynamic shape to generate lift, but it is desirable to minimise disturbance of the laminar flow.

Preferably the aerodynamic shroud is adapted to enclose plural processing apparatus, for example plural filling apparatus or sealing apparatus. For example plural units of processing apparatus may be arranged in a straight line row, for example to perform the process on articles, such as vials arranged in a corresponding row adjacent to, e.g. below the processing apparatus and into an operating relationship with which the processing apparatus can be moved, preferably in a direction parallel to the airflow. To surround such a row the aerodynamic shroud may extend linearly along the row so that a cross section through the shroud cut across the row has the above-mentioned aerofoil section. The overall shape of such a shroud may therefore be generally similar to an aircraft wing, with its leading edge uppermost and its trailing edge downwards.

In a preferred construction of the shroud, the shroud comprises two part-shrouds, elongated in a direction perpendicular to the direction of the laminar flow, and hinged at their respective leading edges to rotate about a hinge axis parallel to the longitudinal direction. The elongate longitudinal direction is preferably the direction of a row of processing apparatus units contained therein. Preferably such part shrouds hinge such that the respective trailing edges become adjacent, preferably meet, most preferably locking together. The part shrouds may be so hinged by their respective leading edges being made in a part-hollow cylindrical shape, the internal diameter of a first part shell corresponding to the external diameter of the second, so that the part-cylindrical shapes can overlap and smoothly rotate relative to each other. Locking together of the trailing edge may for example be by means of a snap fit, friction fit or interlocking fit etc of the trailing edges of these part-shrouds. Preferably such two part-shrouds may also be supported by, and optionally at least one part shroud may be hinged to, a support rail at the leading edge, for example in the above-described construction a cylindrical support rail corresponding in radius to the radius of the internal radius of the first part shroud.

The hinging together of the two part-shrouds enables the construction of the shroud as a hollow shell with the part-shrouds comprising part-shells, e.g. a so called "clamshell".

The construction of the shroud as a hollow shell able to be opened at its trailing edge by the hinging of the two part-shrouds of the trailing edge facilitates the provision of one or more internal supports on one or more inner surfaces of one or both part-shroud for the processing apparatus.

For example a part-shroud may have one or more supports on its inner surface to hold the processing apparatus. If there are plural processing apparatus units, e.g. plural filling needles and their associated connectors such as luer locks, then each part-shroud may have holders for a part, e.g. half, of the total number of apparatus. For example along the linear direction of a row of plural apparatus units the individual apparatus units may be held by the two part-shrouds in a longitudinally staggered arrangement, and the arrangement of supports in each part shroud may be staggered to provide this. An analogous construction may be used for a processing station which is a sealing station as mentioned above.

A hollow construction of the shroud also allows the hollow interior to contain other parts of the processing apparatus, for example supply conduits for the medicament etc., one or more light guide such as an optical fibre to direct intense light, one or more thermal sensor, fume conduits leading from exhaust manifolds etc. The internal space within such a hollow shroud may contain the optical fibre(s) and/or electrical cabling for such devices as the thermal sensors, or other components of a processing station to enable them to be connected to ancillary equipment such as control equipment etc. By enabling parts such as supply conduits, electrical cables etc to be contained within the hollow shroud, the hollow construction also reduces the risk of accidental change to these parts, or their catching on other parts of the processing station or of an overall machine with which it operates. Normally the interior of such a hollow shroud will be sterilised prior to use. The hollow shroud can also be made substantially airtight to prevent any entry or exit of contamination.

The shroud may be made of materials suitable for a GMP standard device, such as stainless steel. Such a material is relatively robust but if necessary internal

supports or reinforcement may be provided such as one or more internal beam, e.g. in the linear direction.

The invention also provides a system for performing a process on an article comprising:

a conveyor to convey plural articles in a conveying direction,

a means to provide a laminar flow of air in an upstream-toward-downstream direction toward the conveyor,

a processing apparatus for performing the operation upon the article,

an aerodynamic shroud around at least part of the apparatus and positioned such that a leading surface of the aerodynamic shroud is upstream of the apparatus,

the processing apparatus being upstream of the conveyor in the laminar flow of air.

The processing station with its shroud may be mounted for use adjacent to, preferably above, the conveyor line for conveying articles such as vials or syringes in a conveyor direction. Suitably the conveyor may transport the articles arranged in rows aligned across the conveyor direction, and the linear direction of the preferred shroud may preferably be perpendicularly across the conveying direction. A processing station comprising a shroud elongated in the linear direction of a row of articles may conveniently be supported at or adjacent its linear ends e.g. on vertically extending supports, and drive means may be provided to move the processing station up and down to perform the operation when the articles are suitably positioned below the processing station. The processing station may be capable of movement only in the up-down direction and the conveyor may for example be temporarily and/or locally stopped during the performance of the operation. Alternatively or additionally the processing station may be movable about a path and at a speed such that on part of the path the processing station moves in parallel with articles on the conveyor in the conveying direction and at the same speed, so that there is zero relative velocity between the station and the article(s). Such a path suitably includes a return path for the station in the opposite direction to the conveying direction.

Preferred features of the processing apparatus and shroud are as above.

The present invention also provides a process for performing an operation on an article using a processing station as described above.

A preferred process comprises filling a medicament vial with a medicament using a hollow filling needle comprising part of the processing station, particularly by passing this needle through a puncturable part of the vial closure to therethrough introduce the medicament into the vial.

Another preferred process comprises sealing a puncture hole in a thermoplastic closure of a vial using a source of intense light comprising part of the processing station, optionally monitoring the temperature of the region of the closure upon which the light is directed using a thermal sensor comprising part of the processing station, and optionally removing fumes from this region using a fume extraction manifold comprising part of the processing station. In this process the processing station and adjacent parts of an overall device for performing the process are preferably maintained in a sterile environment in which a laminar flow of purified air is directed downward over the processing station.

The invention will now be described by way of example only with reference to the accompanying figures which show:

Fig. 1 – A cross section through a shroud and processing apparatus unit of this invention, with the shroud closed

Fig. 2 – A cross section through the shroud of Fig. 1 with the shroud open

Fig. 3 – A perspective view from below of the closed shroud and plural units of Fig. 1

Fig. 4 – A perspective view from above of the open shroud of Fig. 2

Fig. 5 - A perspective view from below of holders on the inner surface of the shroud of Figs. 1 to 4

Fig. 6 - a schematic view from above of a processing station and a row of vials on a conveyor for processing

Fig. 7 - a cross section through a shroud and a sealing apparatus.

The following features are disclosed in these drawings.

10 shroud

10A, 10B part shrouds

11,12 leading edges

13 support rail
14, 15 overlapping parts
16, 17 supports for a vial filling apparatus
16A, 16B indentations
18 aperture
19 interior of the shroud
110 trailing edge
20 vial filling apparatus
21 hollow filling needle
22 luer connector
23 flow conduit
30 conveyor line
40 vials
41 puncturable closure
42 residual puncture hole
50 supports
60 sealing station
61 aerodynamic shroud
62 trailing edge
63 internal support beam
64 light guides
65 fibre optic light guide
66 beam of laser light
67 thermal sensors
68 cables
69 exhaust manifolds

Referring to Fig. 1 a shroud 10 is shown in cross section, comprising part of a processing station for filling plural vials (not shown). For processing the vials are arranged in a straight line row, the linear direction of which is perpendicular to the drawing, the cross section of the shroud 10 shown consequently being across this linear direction. In cross section the external shape of the shroud 10 is a

symmetrical pear shape elongated along the up-down direction, widest at the upper end.

The shroud 10 comprises two part-shrouds 10A, 10B which are hinged by their respective leading edges 11, 12 being made in a part-hollow cylindrical shape, the internal diameter of the leading edge of the first part shell 10A corresponding to the external diameter of the leading edge of the second 10B, so that the part-cylindrical shapes can overlap and smoothly rotate relative to each other in a smooth hinging fit. Internally there is a cylindrical sectioned support rail 13 extending in the linear direction and over which the cylindrical section 12 conformingly fits.

At their lower ends the two part shrouds 10A, 10B have respective overlapping parts 14, 15 which meet and interlock by a friction fit to form a lower edge of the shroud 10. The overlapping parts 14, 15 may also be connected together by fastening means (not shown).

Internally each part-shroud 10A, 10B is provided on an inner surface with supports 16, 17 for a vial filling apparatus 20. As is seen more clearly in Fig. 5 each support 16, 17 comprises a shelf having indentations 16A, 17A to receive a part of the apparatus 20, which as shown is of an overall stepped cylindrical shape. Also, as shown, the bottom edge 10C of each part shroud 10A, 10B has an appropriately shaped aperture 18 therein to receive the apparatus 20 and to allow it to project through and beyond the lower edge 10C, The apparatus 20 comprises a hollow filling needle 21 at the lower end of a luer connector 22 which enables the filling needle 21 to be connected to a flow conduit 23 which is enclosed within the interior 19 of the shroud 10. Fig. 3 shows how plural apparatus units are held and enclosed by shroud 10.

In each part shroud 10A, 10B the units of apparatus 20 are supported in alternate indentations 16,17 and in the pre-closed assembly shown in Fig. 4 the units 20 in respective part shrouds 10A,10B are supported longitudinally staggered.

Figs. 2 and 4 shows how the two part shrouds 10A, 10B can open about the axis of the hinge 11, 12, 13 to allow access to the interior of the shroud 10. Two processing apparatus units 20 are shown in Fig. 2 held by respective supports 16, 17 on respective opposite facing inner surfaces of the part shrouds 10A, 10B. On the opposite facing inner surfaces the units 20 are held in a staggered arrangement as

seen more clearly in Fig. 4, facilitating access to the interior of each part shroud 10A, 10B. The shroud 10 has a trailing edge 110.

Fig. 6 shows the shroud 10 and its associated units 20 (one only shown, hatched) in use. The two part shrouds 10A,10B together with their associated units 20 and preferably all other components to be enclosed within the shroud may be sterilised by autoclaving before the shroud is closed, to give an assurance of sterility. The shroud 10 is located above a conveyor line 30 transporting empty vials 40 each vial 40 being closed at its upwardly facing mouth by a puncturable closure 41. The conveyor line 30 is transporting the vials 40 in a conveyor direction shown by arrow 30A, and on the conveyor 30 plural vials 40 are arranged in holders (not shown) on the conveyor 30 in a row extending perpendicularly across the conveyor line 30, with the upper surface of their puncturable closures 41 facing upwards. A downward laminar flow of purified air is directed over the shroud 10 and conveyor 30 as indicated by the bold arrow.

In Fig. 6 each unit 20 is positioned directly above the closure 41 of a corresponding vial 40 beneath. The relative velocity of each unit 20 and vial 40 in the conveying direction is temporarily zero, which may be achieved by means known in the art. For example the conveyor 30 may be temporarily stopped, or alternatively the shroud 10 may be moved about a path shown schematically 50A-D over length 50A of which the shroud 10 and vials 40 have the same velocity and hence zero relative velocity. The supports 50 may incorporate suitable mechanisms to achieve such "walking" motion.

The shroud 10 is supported at its ends 10C, 10D on opposite sides of the conveyor line 30 on supports shown schematically 50, and is moveable up and down thereon by a drive means (not shown) of conventional construction and operation. With the conveyor line 30 and the shroud 10 temporarily at zero relative velocity the shroud 10 and its associated units 20 is moved downwards, e.g. along length 50D, so that needles 21 puncture the closures 41 of each of the vials 40. Adjacent one longitudinal end of the shroud 10 are located control equipment (not shown), and reservoirs of medicament and metering pumps for the medicament, (not shown) to which the flow conduits 23 to ensure that the shroud 10 and vials 40 are in an appropriate configuration for the filling operation to be carried out, and to meter an

appropriate quantity of medicament into each vial 40. The vials 40 may then be filled with a suitable amount of a medicament via flow conduits 23, and the needles 21 may then be withdrawn by an upward movement of the shroud, e.g. along length 50B, from their respective vials 20, leaving only a small residual puncture hole 42 in closure 41. The inherent resilience of the elastomeric material of the closures 41 tends to keep the interior of the vial 40 sealed against contamination, but the closures 41 are then sealed using a further processing station comprising a sealing station which will be described below. The flow conduits 23 are connected to metering pumps (not shown) and reservoirs (not shown) for the liquid medicament, and preferably the construction is such that the length of each flow conduit 23 between the unit 20 and the pump is the same, to facilitate a uniform flow of the medicament.

Prior to the filling operation all of the components 10, 20, 30, 40, 50 have been thoroughly sterilised and during the filling operation the entire assembly of shroud 10 and its units 20, conveyor 30, vials 40 and supports 50 are maintained in a sterile enclosure (not shown) and under a downward flow of sterile air in the direction of the arrows. The smooth, aerodynamic profile of the outer surface of the shroud 10 ensures a smooth undisturbed flow of the sterilised air downwards, and the absence of recesses, corners etc therein inhibits the accumulation of any contaminating microorganisms.

After the above-described filling operation the conveyor 30 transports the vials 40 to a sealing station 60 illustrated in Fig. 7 which shows a cross section cut along the length of a row of vials 40 on a conveyor (not shown). The sealing station 60 comprises an aerodynamic shroud 61 of generally similar construction to that shown in Figs. 1-6, only the lower, trailing edge 62 of which is shown in Fig. 7, the upper edge of which is substantially identical to that shown in Figs. 1-6. Internally the shroud 60 supports plural light guides 63 each of which is connected to a fibre optic light guide 64 for the direction of laser light from a suitable laser (not shown) e.g. a commercially available $CO_2$ laser typically operating at 10.6 $\mu$m, or a YAG laser typically operating at 1.06 $\mu$m, typically at laser energies of 20W or greater. Each light guide 63 is mounted in the lower edge 62 so as to project through an aperture 65 to enable a beam of laser light 66 to be directed therefrom at the closure

41 of a vial 40. Also mounted in apertures 67 in the lower edge 62 are thermal sensors 68 in number corresponding to the light guides 63, and each directed at the region of a vial closure 41 of which the laser light 66 is directed, and connected via cables 69 to control equipment (not shown) to monitor that the upper surface of each vial closure 41 reaches a temperature such that the region fuses to seal the residual puncture hole. Also mounted in the lower edge 62 are exhaust manifolds 610 via which any fumes 611 emitted from a closure 41 as it is heated by the laser light 66 can be removed via main manifold 612 running longitudinally along the internal length of shroud 61. As with the filling station described above a flow of sterile air may be directed downwardly over the shroud 61, the surface of which causes minimal disruption of the flow of air.

The shroud 61 may be in the form of two part-shrouds hinged at its upper edge (not shown) in a similar manner to the shroud shown in Figs. 1-6. At the lower edge 62 the respective lower edges of the part shrouds may meet and/or overlap in a manner as described for the shroud 10 shown in Figs. 1-6 along a line between the lower exposed surfaces of the light guides 63 and thermal sensors 68. By such a construction supports (not shown) may be provided for the light guides 63 and thermal sensors 68 in each part shroud in a manner analogous to the supports 16, 17 in the shroud 10 shown in Figs. 1-6.

The sealing operation is carried out analogously to the above-described filling operation, i.e. the station 60 and vials 40 are temporarily set at zero relative velocity, and with the station moved downwardly laser light 66 can be directed at the residual puncture hole 42 in the vial closure 41 to thereby seal the hole. The thermal sensor 68 monitors the temperature at the site of the puncture hole 42 to confirm that a suitable temperature has been reached to seal the closure 41, and any fumes 611 may be extracted via the manifold 610, 612. Control equipment (not shown) can be used to ensure that the station 60 and vials 40 are in an appropriate configuration to perform this operation.

## Claims

1. A processing station for performing an operation on an article in a laminar upstream to downstream direction flow of purified air which comprises;

a processing apparatus for performing the operation upon the article,

an aerodynamic shroud around at least part of the apparatus and positioned such that a leading surface of the aerodynamic shroud is upstream of the apparatus.

2. A processing station according to claim 1 wherein the processing station is a processing station for performing an operation on a medicament vial or a syringe.

3. A processing station according to claim 1 or 2 wherein the article, or plural articles, is/are mounted on a conveyor system located downstream of the processing station relative to the airflow.

4. A processing station according to any one of the preceding claims wherein part(s) of the processing apparatus at the downstream (e.g. lower) end of the aerodynamic shroud is exposed to enable interaction thereof with the article upon which the processing station is to operate.

5. A processing station according to any one of the preceding claims wherein, in its upstream-downstream direction the shroud has a generally aerofoil section.

6. A processing station according to claim 5 wherein the shroud has an elongated elliptical section or an elongated pear-shaped section.

7. A processing station according to claim5 or 6 wherein the section is symmetrical.

8. A processing station according to any one of the preceding claims wherein the aerodynamic shroud is adapted to enclose plural processing apparatus.

9. A processing station according to claim 8 wherein plural units of processing apparatus are arranged in a straight line row to perform the process on articles arranged in a corresponding row adjacent to the processing apparatus and into an operating relationship with which the processing apparatus can be moved.

10. A processing station according to claim 9 wherein the processing apparatus can be moved in a direction parallel to the airflow.

11. A processing station according to any one of the preceding claims wherein the shroud comprises two part-shrouds, elongated in a direction perpendicular to the direction of the laminar flow, and hinged at their respective leading edges to rotate about a hinge axis parallel to the longitudinal direction.

12. A processing station according to claim 11 wherein the part shrouds hinge such that the respective trailing edges become adjacent.

13. A processing station according to claim 11 or 12 wherein the part shrouds are hinged by their respective leading edges being made in a part-hollow cylindrical shape, the internal diameter of a first part shell corresponding to the external diameter of the second, so that the part-cylindrical shapes can overlap and smoothly rotate relative to each other.

14. A processing station according to any one of claims 11 to 13 wherein the two part-shrouds are supported by a support rail at the leading edge.

15. A processing station according to claim 14 wherein at least one of the part-shrouds is hinged about the support rail.

16. A processing station according to any one of claims 11 to 14 wherein the shroud comprises a hollow shell with the part-shrouds comprising part-shells.

17. A processing station according to any one of claims 11-15 wherein a part-shroud has one or more supports on its inner surface to hold a processing apparatus.

18. A processing apparatus according to claim 17 wherein there are plural processing apparatus units and each part-shroud has holders for a part of the total number of apparatus.

19. A processing station according to claim 18 wherein plural apparatus units are supported in a longitudinal row within the shroud and the individual apparatus units are held by the two part-shrouds in a longitudinally staggered arrangement.

20. A processing station according to any one of the preceding claims wherein the operation is a filling operation for a medicament container, the processing apparatus for performing the operation comprising a filling apparatus.

21. A processing station according to any one of the preceding claims wherein the operation is a sealing operation where a vial or syringe is closed by a puncturable thermoplastic closure having a residual puncture hole therein, the processing apparatus comprising a source of intense light which may be directed onto the region of the residual puncture hole to fuse the material of the puncture hole around the hole.

22. A system for performing a process on an article comprising:

a conveyor to convey plural articles in a conveying direction,

a means to provide a laminar flow of air in an upstream-toward-downstream direction toward the conveyor,

a processing apparatus for performing the operation upon the article,

an aerodynamic shroud around at least part of the apparatus and positioned such that a leading surface of the aerodynamic shroud is upstream of the apparatus,

the processing apparatus being upstream of the conveyor in the laminar flow of air.

23. A process for performing an operation on an article using a processing station as claimed in any one of claims 1 to 21.

22. A process according to claim 21 which comprises filling a medicament vial with a medicament using a hollow filling needle comprising part of the processing station.

23. A process according to claim 21 which comprises sealing a puncture hole in a thermoplastic closure of a vial using a source of intense light comprising part of the processing station.

Fig-1

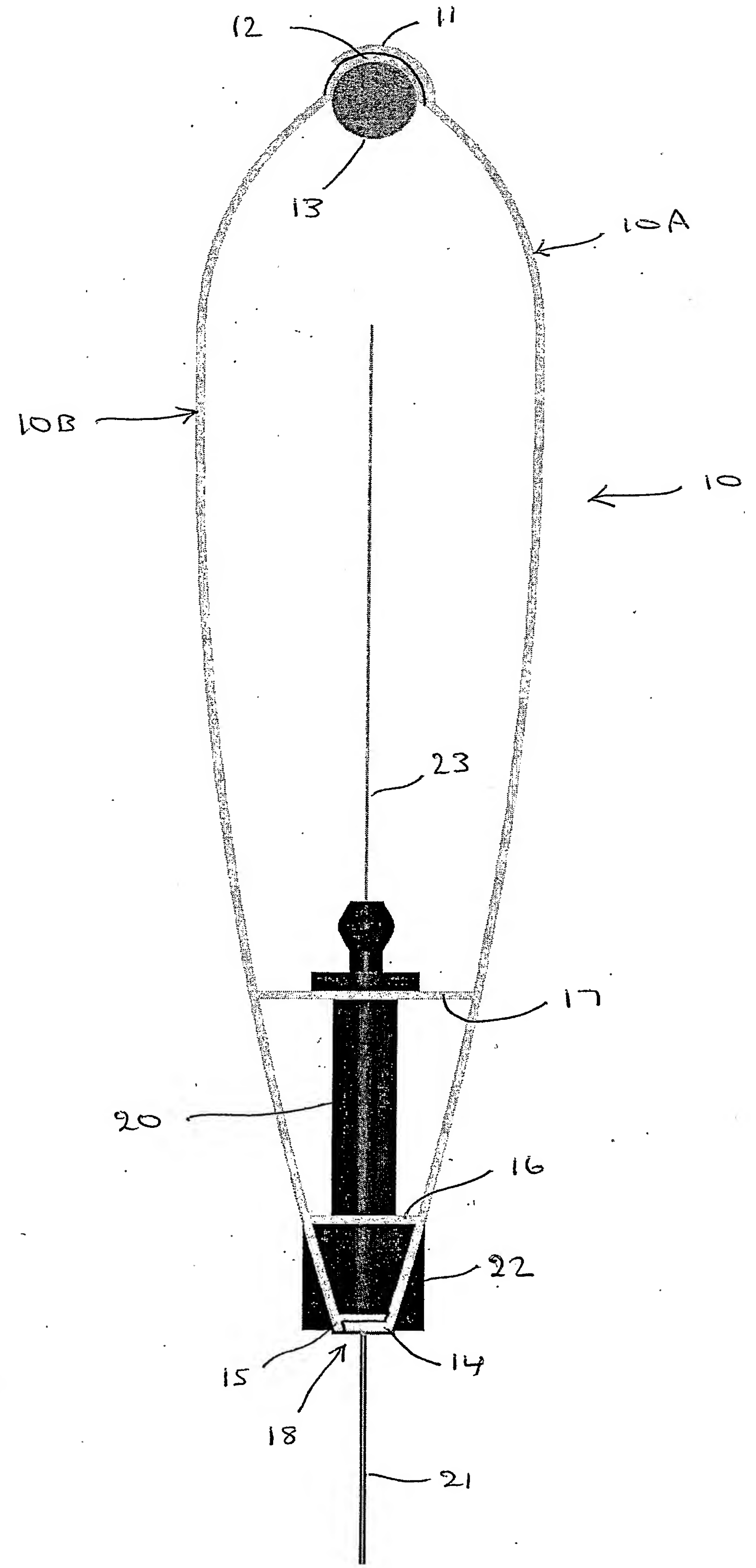


Fig. 2

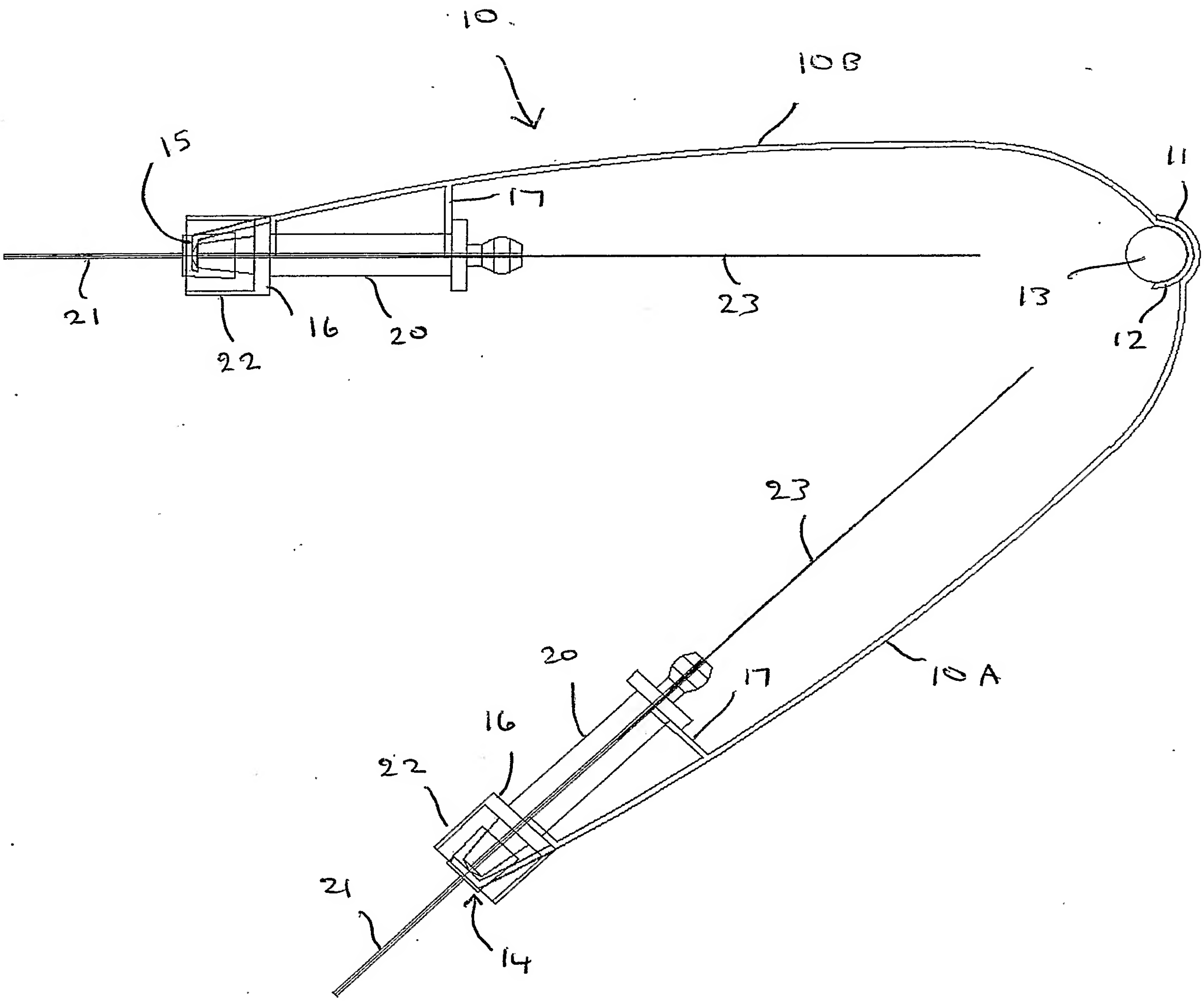


Fig. 3

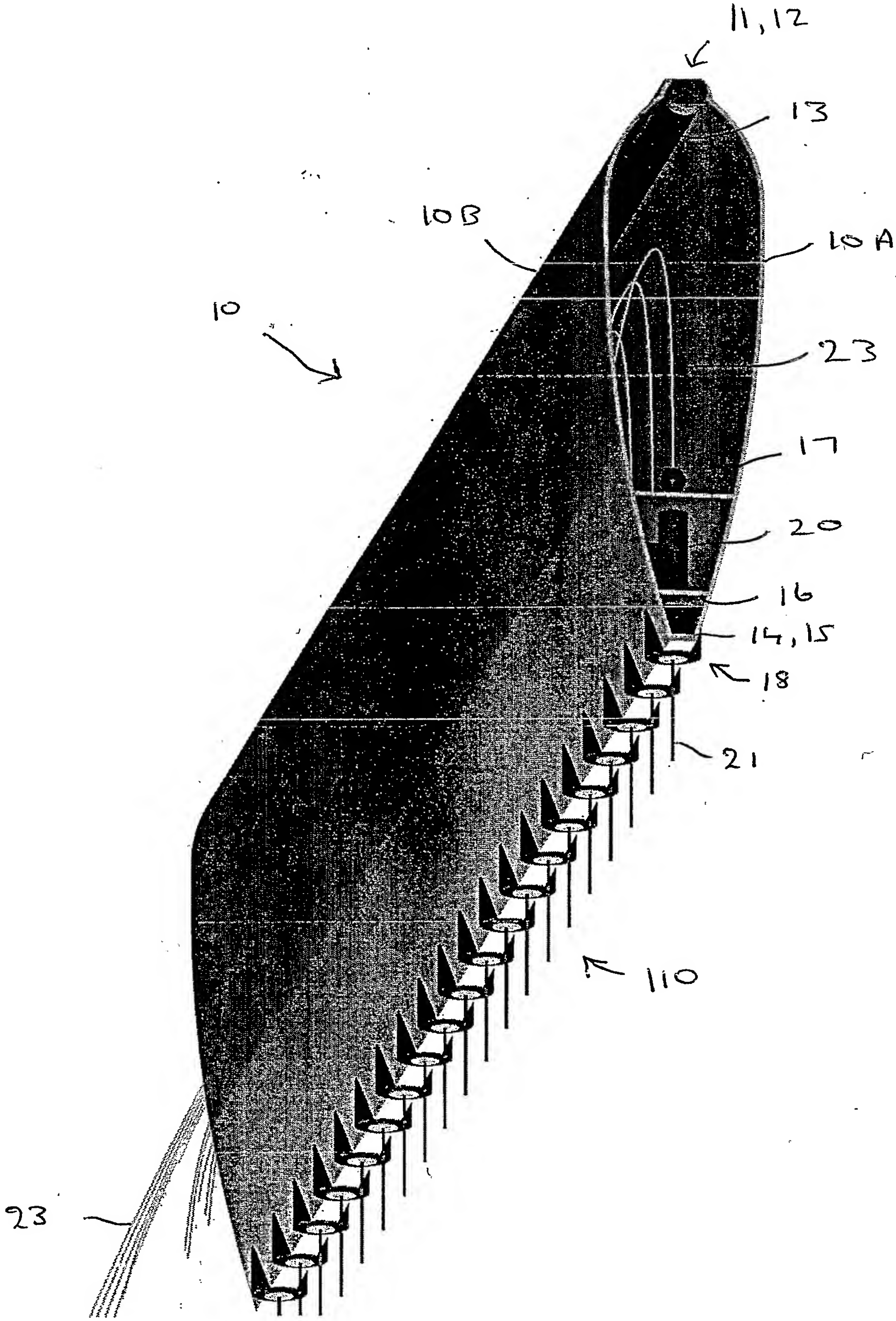


Fig-4

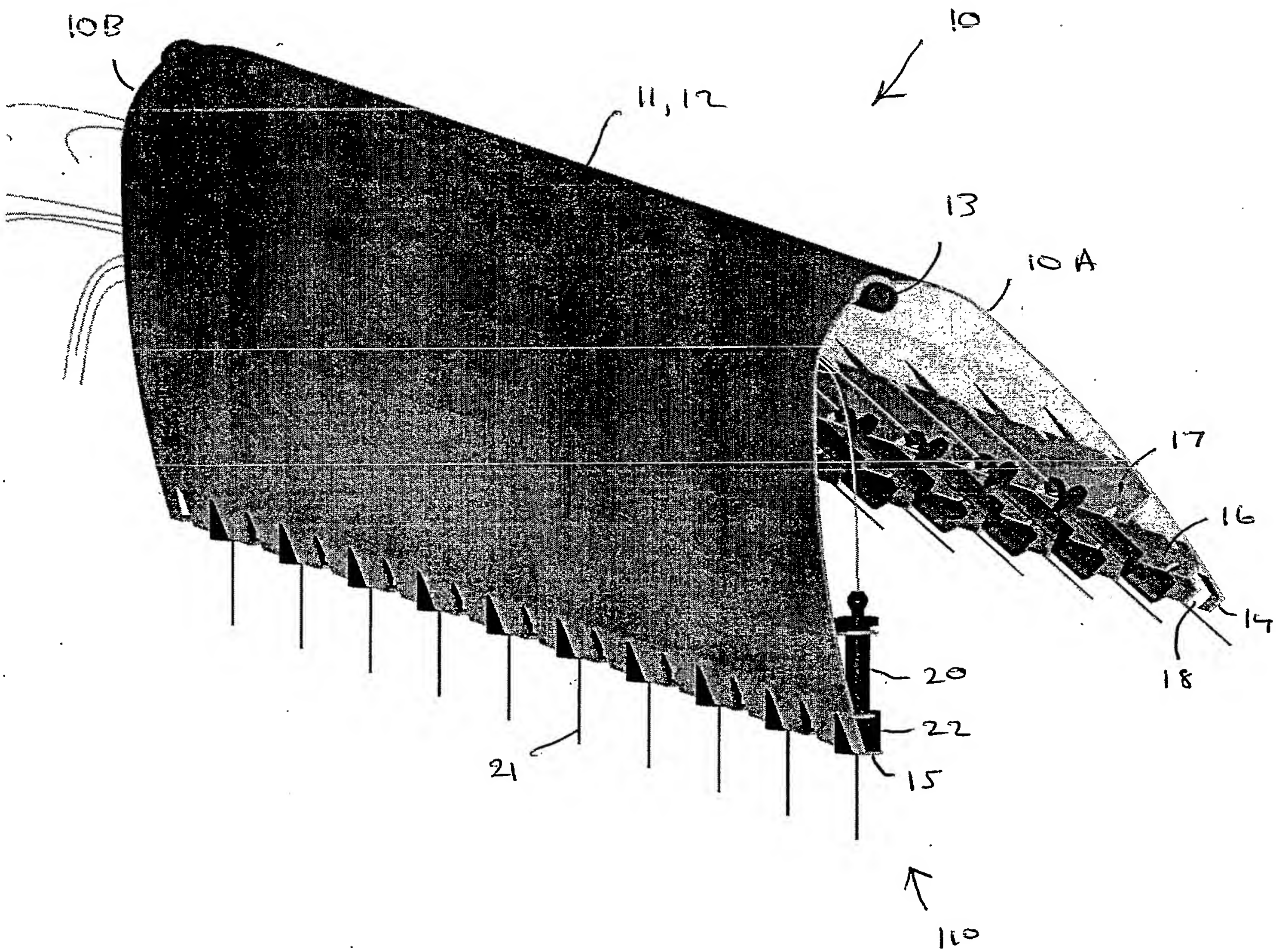


Fig. 5

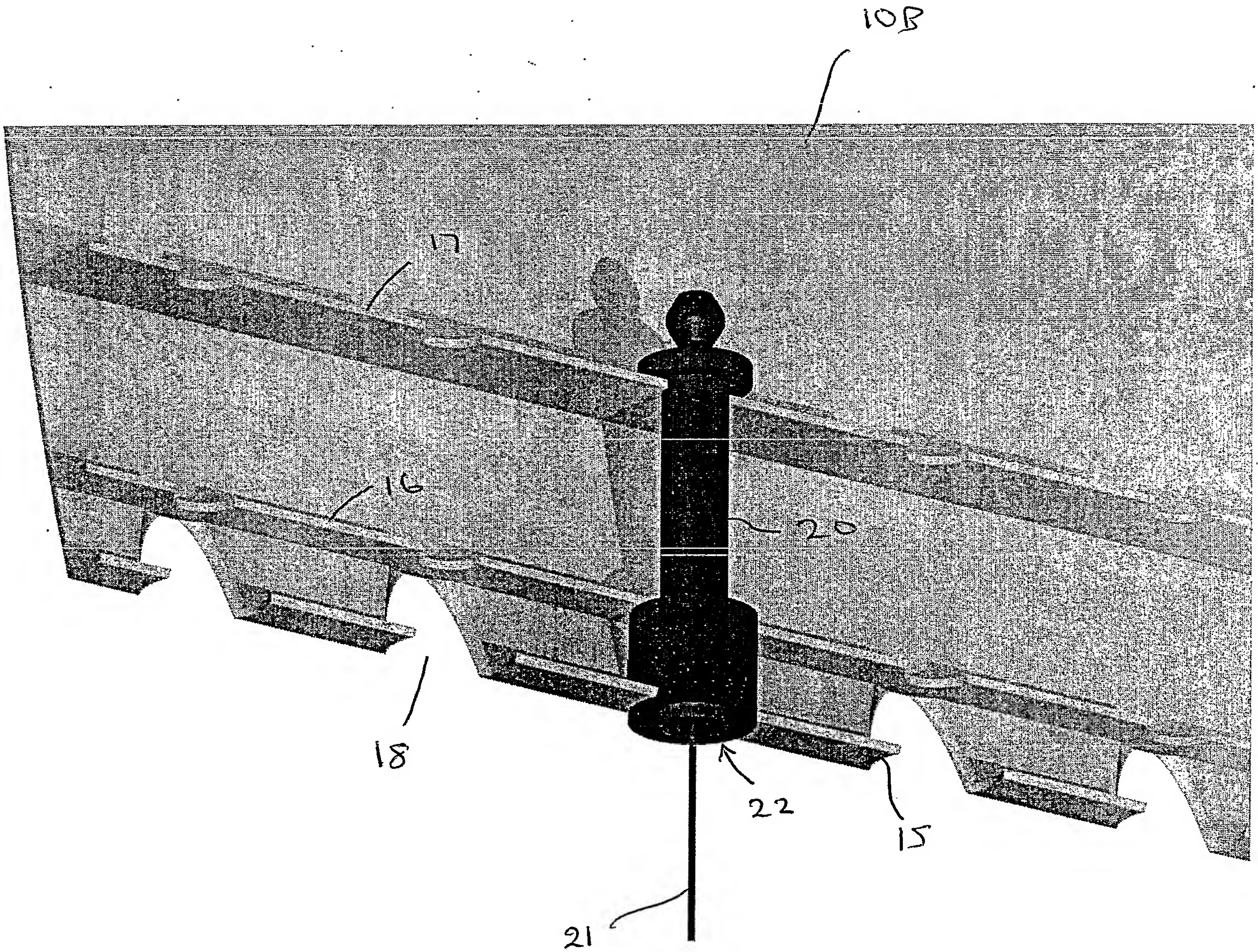
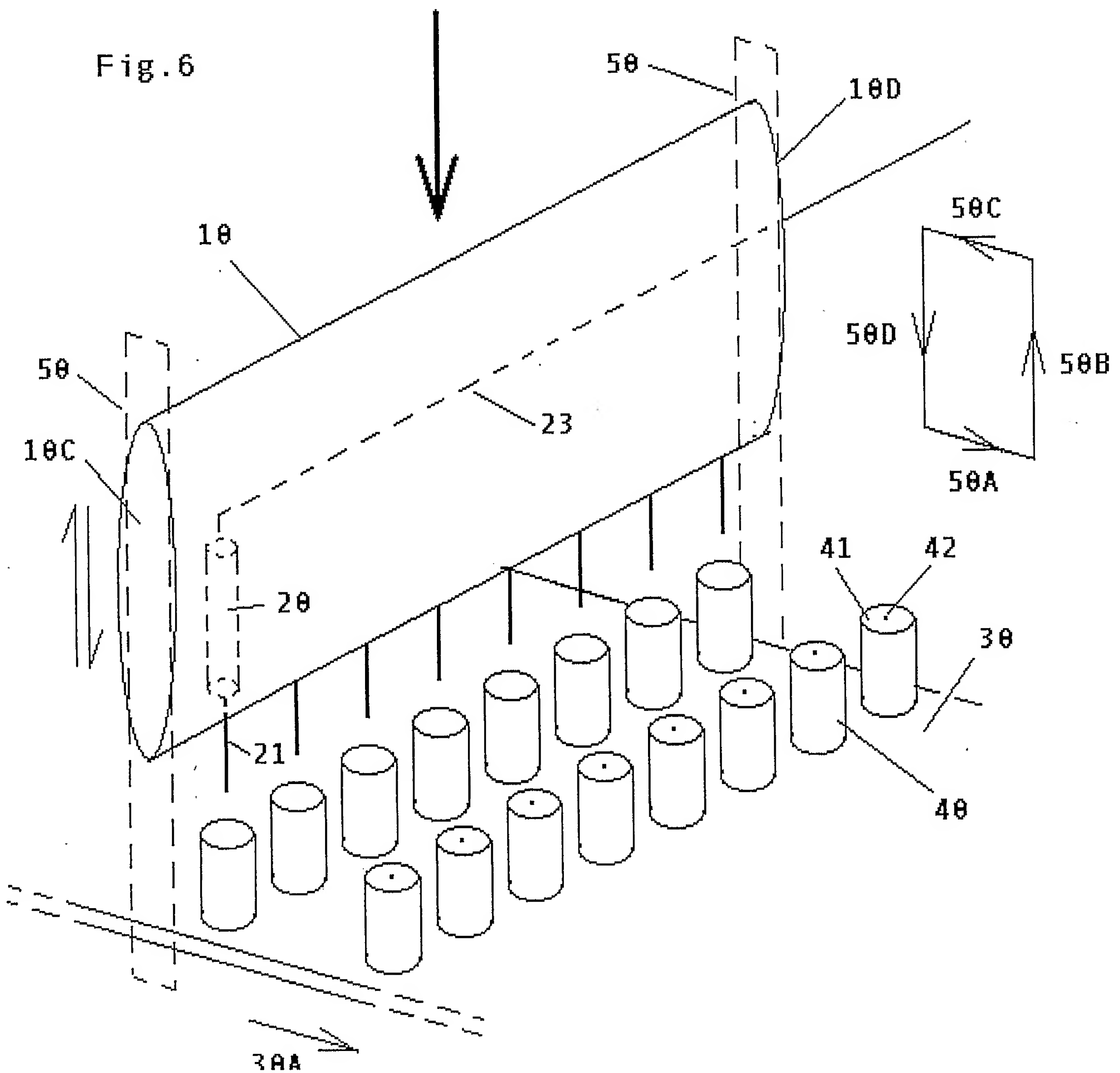


Fig.6



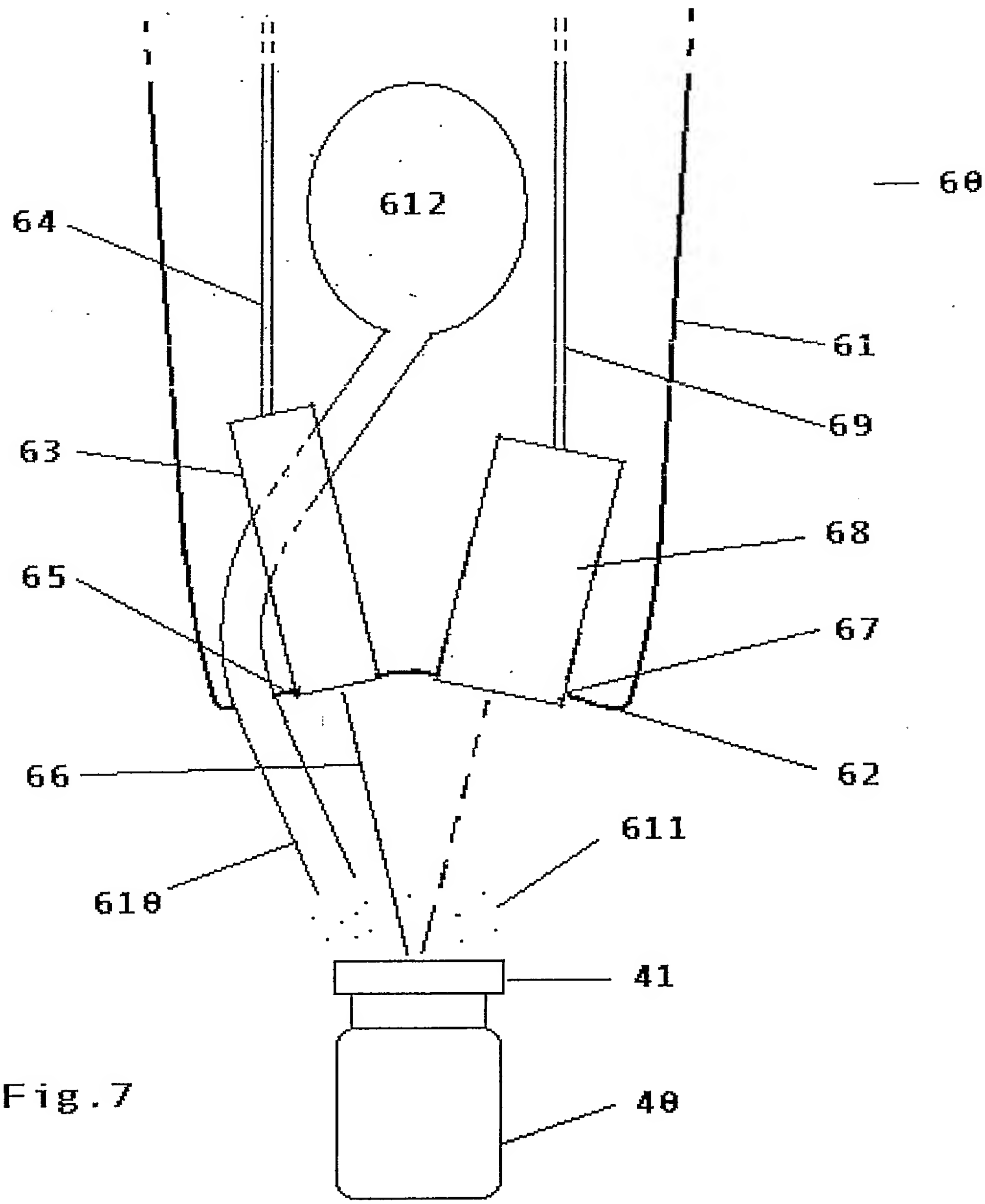



Fig.7